

Article 19 And 4

The claims under Article 19

WHAT IS CLAIMED IS;

1. A soldering method in which, out of soldering steps
5 of (a) during soldering, (b) before soldering, and (c) after
soldering, in at least the steps of (a) during soldering and
(b) before soldering, an alternating current whose frequency
temporally changes in a band of 20Hz-1MHz is applied to at least
any of (d) a solder material, (e) a soldering object, and (f)
10 a peripheral portion thereof, and a modulated electromagnetic
wave treatment is carried out by use of an electromagnetic field
induced by the alternating current.

2. The soldering method according to Claim 1, wherein
the modulated electromagnetic wave treatment in the soldering
15 steps of (a) during soldering, (b) before soldering, and (c)
after soldering includes at least any electromagnetic wave
treatment of an electromagnetic wave treatment
(electromagnetic wave treatment 1) to a flux liquid itself in
a flux treatment step, an electromagnetic wave treatment
20 (electromagnetic wave treatment 2) to a flux treatment space,
an electromagnetic wave treatment (electromagnetic wave
treatment 3) to a preheater space in a preheater treatment which
is carried out for a flux-treated soldering object, an

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electromagnetic wave treatment (electromagnetic wave treatment

4) carried out during soldering, an electromagnetic wave treatment (electromagnetic wave treatment 5) to a soldering space, and an electromagnetic wave treatment (electromagnetic 5 wave treatment 6) to a cooling space in a cooling step for a soldering object after soldering.

3. The soldering method according to Claim 1, wherein soldering is a soldering method of (a) a flow type whereby a molten solder material is sprayed on a soldering object, (b) 10 a reflow type whereby a soldering object with a cream solder material applied is heated, or (c) a soldering iron type whereby soldering is carried out by holding a soldering iron to a soldering object with a solder material applied, (d) a laser type or (e) an induction heating type.

15 4. The soldering method according to Claim 1, wherein the solder material is a lead-free solder material or a lead-containing material.

5. The soldering method according to Claim 1, wherein the lead-free solder material is a solder alloy of an Sn-Ag-Cu 20 base, an Sn-Ag base, an Sn-Ag-Bi base, an Sn-Ag-In base, an Sn-Cu base, an Sn-Zn base, an Sn-Bi base, an Sn-In base, Sn-Sb base, an Sn-Bi-In base, an Sn-Zn-Bi base, or an Sn-Ag-Cu-Sb base.

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6. The soldering method according to Claim 1, wherein the lead-free solder material has a solder composition which is reduced in Ag content (% by weight) of a solder alloy of a 96.5%Sn-3.0%Ag-0.5%Cu base or a solder alloy of a 5 96.0%Sn-3.5%Ag-0.5%Cu base to a ratio of 0.5% to above 0% and which uses the reduced amount of Ag as an increasing amount of an Sn content.

7. The soldering method according to Claim 1, wherein in addition to the modulated electromagnetic wave treatment, 10 soldering is carried out while a longitudinal direction of a stick member provided with a coil which conducts an alternating current whose frequency temporally changes in a band of 20Hz-1MHz is oriented in the direction of the soldering object.

8. The soldering method according to Claim 1, wherein 15 simultaneously with the modulated electromagnetic wave treatment, another electromagnetic wave treatment including an infrared and/or far-infrared treatment is used in a step before or after soldering.

9. A soldering device comprising:
20 a solder material applying portion for applying a solder material to a soldering object;

a soldering object and/or a solder material for soldering of the soldering object, and/or a coil-wound coil portion

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provided in the vicinity of the solder material, and an electromagnetic wave generator which applies an alternating current whose frequency temporally changes in a band of 20Hz-1MHz to an electric wire of the coil portion.

5 10. A soldering device according to Claim 9, wherein in addition to the coil portion, provided is a stick member onto which a coil which conducts an alternating current whose frequency temporally changes in a band of 20Hz-1MHz has been wound and whose longitudinal direction has been oriented in
10 the direction of the soldering object.

11. A soldering device according to Claim 10, wherein the solder material applying portion is composed of a molten solder storing molten solder bath attached with a preheating device and/or a flux treatment device and a molten
15 solder supply pipe with an exhaust nozzle to spout the molten solder toward the soldering object, disposed in the molten solder bath,

the coil portion is provided in the vicinity of the molten solder bath and/or in the molten solder supply pipe.

20 12. A soldering device according to Claim 11, wherein the coil portion provided in the vicinity of the molten solder bath is provided, in the molten solder bath including the preheating device and/or flux treatment device, in the

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vicinity of the soldering object on the inside and/or outside of the molten solder bath before being soldered and/or after being soldered.

13. A soldering device according to Claim 11, wherein
5 the molten solder supply pipe disposed in the molten solder bath is provided with a molten solder intrusion-preventing pipe connected to an outer peripheral portion thereof, and the coil portion is constructed by inserting a coil into the molten solder supply pipe via the inside of the molten solder 10 intrusion-preventing pipe and winding the same.

14. A soldering device according to Claim 13, wherein the coil portion is constructed by winding, onto a coil installing member connected to the molten solder intrusion-preventing pipe through the inside of the molten 15 solder intrusion-preventing pipe, a coil introduced onto this coil installing member through the inside of the molten solder intrusion-preventing pipe.

15. A soldering device according to Claim 14, wherein a longitudinal direction of the coil installing member 20 is connected, inside the molten solder intrusion-preventing pipe, to in the direction orthogonal to a longitudinal direction of the molten solder supply pipe.

16. A soldering device according to Claim 14, wherein

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the coil provided onto the coil installing member has been wound around the coil installing member by single winding or double or more lap winding.

17. A soldering device according to Claim 14, wherein
5 the coil installing member is provided double with a parallel arrangement in a longitudinal direction of the molten solder supply pipe, and onto these coil installing members, a coil is wound in a figure of zero or in a figure of eight across the two coil installing members.

10 18. The soldering device according to Claim 9, wherein the solder applying portion is provided with a transfer means for transferring a solder object provided by applying a cream solder to a solder object from an upstream side to a downstream side, a heating means for heating the soldering object
15 being transferred by the transfer means, and a cooling means, and

the coil portion is provided with a coil wound around the transfer means for transferring the solder object.

19. The soldering device according to Claim 18, wherein
20 the coil portion is constructed by arranging a coil in a direction orthogonal to a transferring direction of a soldering object transferred by the transferring means and so as to surround the soldering object.

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20. The soldering device according to Claim 18, wherein
the heating means is composed of a preheating portion
provided on an upstream side in the transferring direction of
the transferring means and a main heating portion provided on
5 a downstream side thereof, and the cooling means is provided
on a downstream side of the real heating portion.

21. The soldering device according to Claim 9, wherein
the solder applying portion is provided with a soldering
iron for carrying out soldering by being made to contact with
10 or being made proximate to a soldering object with a solder
applied, and

the coil portion is constructed by winding a coil around
a part of the soldering iron.

22. A method for manufacturing soldered articles, wherein
15 the soldering method according to Claim 1 is incorporated
in manufacturing steps.

23. The method for manufacturing a soldered article
according to Claim 22, wherein

20 the soldered article is electronic/electrical equipment
which requires soldering including a semiconductor device.

24. A soldered article obtained by the soldering method
according to Claim 1.

25. The soldered article according to Claim 24, wherein

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the soldered article is electronic/electrical equipment which requires soldering including a semiconductor device.

26. A method for manufacturing a soldered article including the soldering device according to Claim 9.

5 27. The method for manufacturing a soldered article according to Claim 26, wherein

the soldered article is (a printed circuit board for) electronic/electrical equipment including a semiconductor device.